UNIVERSITE D'EVRY
VAL D'ESSONNE

EVRY IUT BRETIGNY-ATHIS MONS

Loughborough University

UTILISATION DE LA NORME ISO 18629 PSL :
Développement industriel : Bâtiment

USE OF THE ISO 18629 PSL STANDARD in a Construction Project

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PREAMBLE :

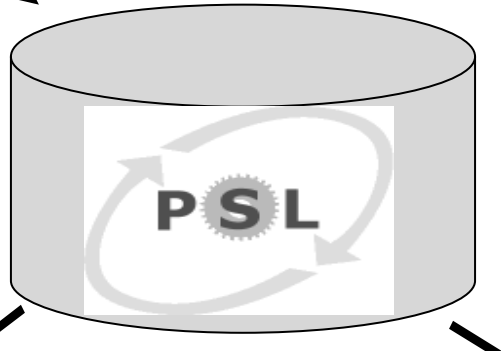
Standard developed by the ISO TC184 / SC4 - SC5 / JWG8

in France : AFNOR CN DSTI/GT3
« *Données de gestion de production*
***et langage de spécification de processus industriels* »**

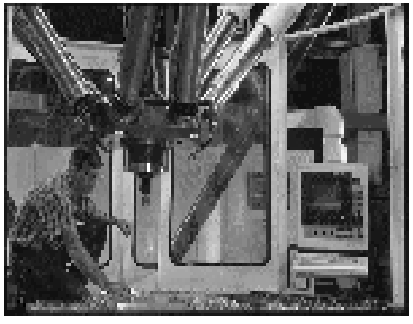
Interoperability of process information

Process Modeler

Design Modeler



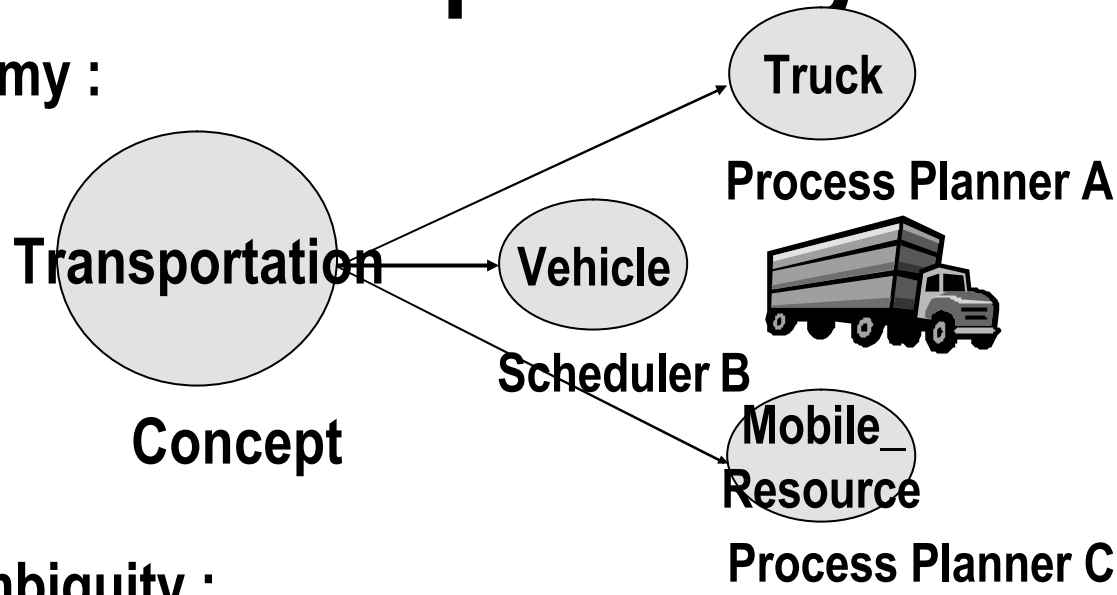
Simulator



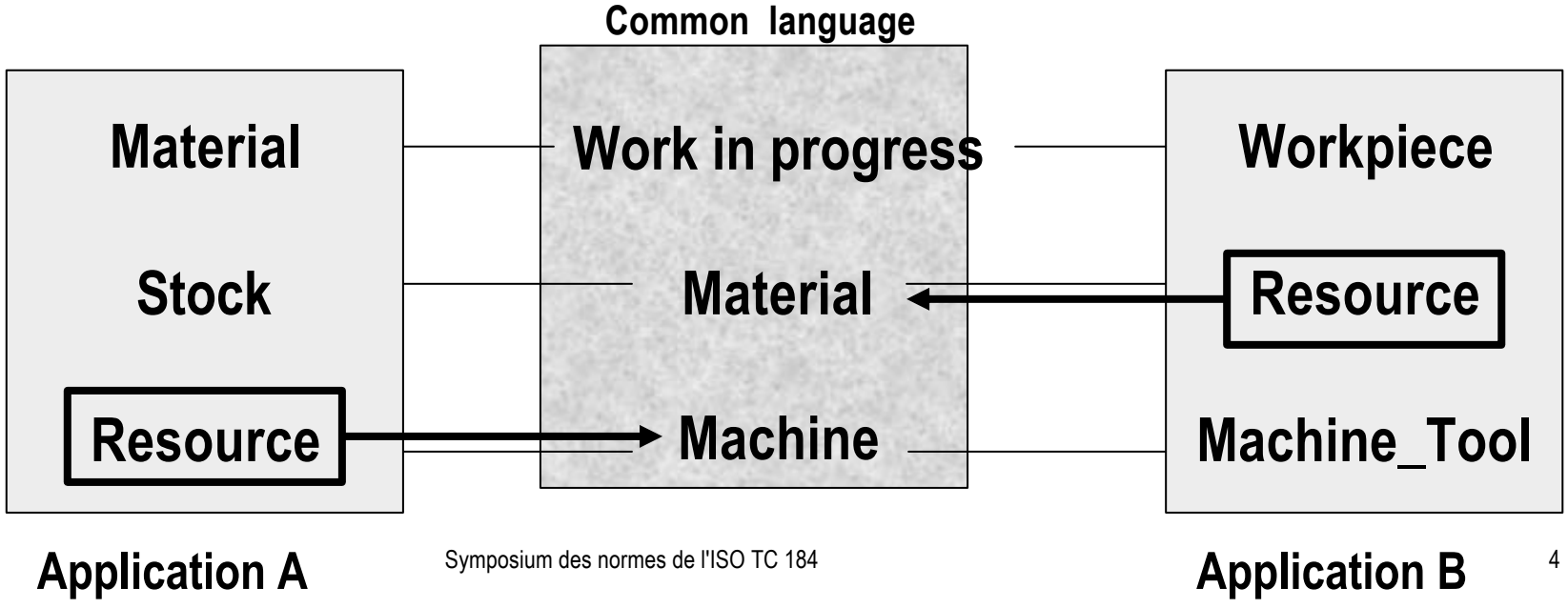
scheduling

Challenges to inter-operability

Semantic challenge 1 : synonymy :



Semantic challenge 2 : term ambiguity :



What is PSL?

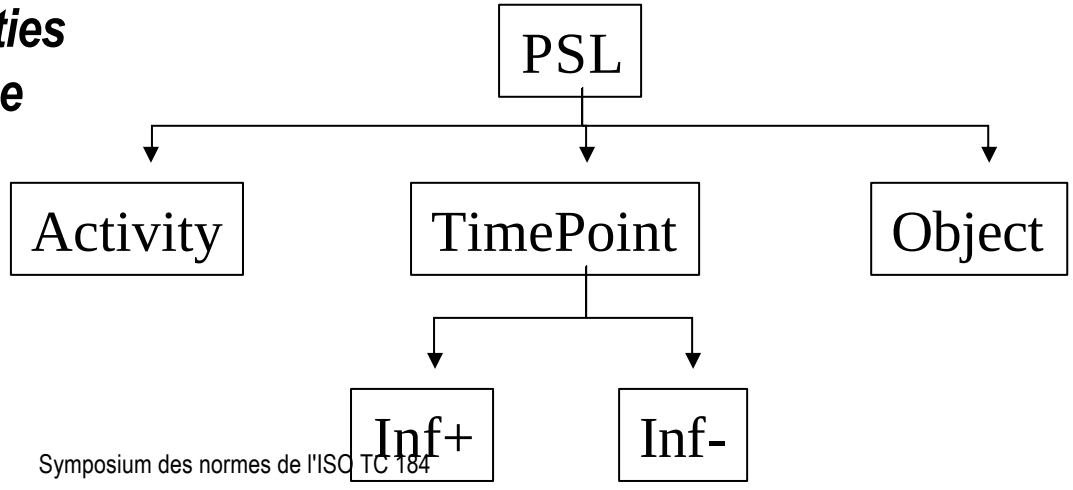
What PSL currently is :

- a 7-year effort at NIST (US) to develop a neutral representation of manufacturing process information,
- a modular, extensible data model (ontology) capturing concepts inherent to process specification

- What PSL will be :
  - a language enabling interoperability of process information amond industrial applications

What is a process ?

A process is one or more activities that occurs over a period of time in which objects participate



What are ontologies ?

- **The basic terms and relations comprising the vocabulary of a topic area**
- **A set of definitions for these terms**
- **The rules for combining terms and relations**

Why are ontologies useful ?

- **Provide definitions and axioms constraining the use of terms** that are readable by machines and understandable by humans
- **Allow hierarchical classification systems, generalization and inheritance, aggregation, and a greater variety of structural relations** than taxonomies and controlled vocabularies

When should ontologies be used ?

- **by humans** : to provide a common frame of reference and some consensus on entities in a domain
- **by machines** : to improve data schemas, system inter-operability based on semantics, agent-based systems

SPECIFICITY OF PSL : ontologies applicable to NOUNS *and* VERBS
==> ORIGINALITY OF THE PSL APPROACH

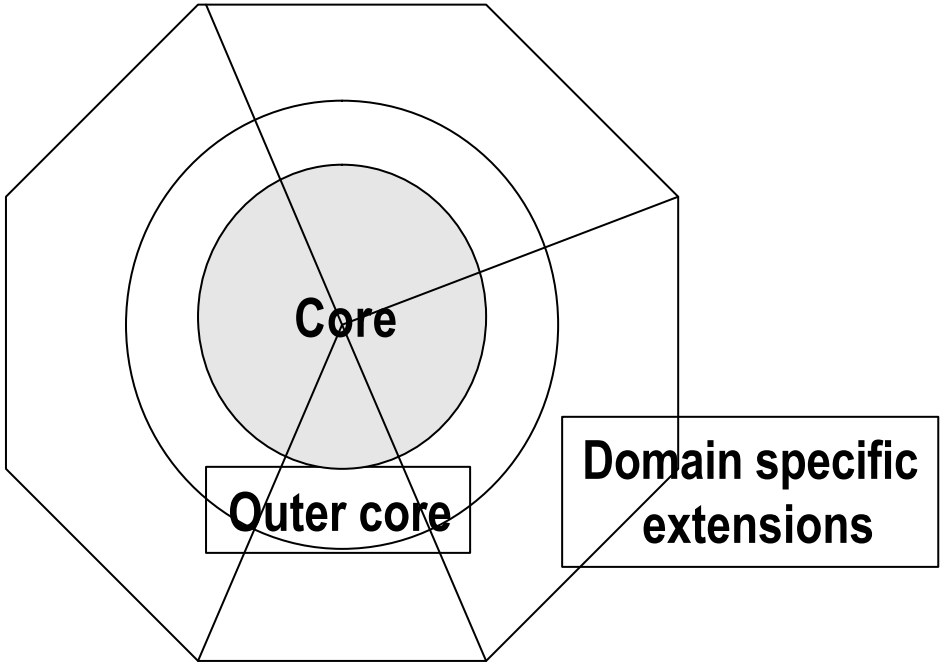
- **Example :** *The duration of an activity is the difference between its start and end times for all occurrences of the activity*

```
(defrelation duration (?a ?d) :=
(forall (?t1 ?t2)
        (=>     (and    (= ?t1 (Beginof_?a))
                        (= ?t2 (Endof ?a)))
                (= ?d (time_minus ?t2 ?t1)))))
```

PSL Structure

- **Objective** : define in a rigourous way concepts necessary for specifying manufacturing processes to enable the exchange of process information

- **Structure** : two main layers :
  - core
  - extensions



PSL Extensions

- **Objectives :**
  enables to represent domain-specific concepts that are not part of PSL core

- **Contents :**
  new constants / predicates, with corresponding axioms

- **Today :**
  - about 330 concepts
  - in 50 extensions

LIST of current extensions (standard)

Part 10 Series: Core Theories

Part 11 : PSL-Core
Part 12 : Outer Core
Part 13 : Duration and Ordering Theories
Part 14 : Resource Theories
Part 15 : Actor and Agent Theories

Part 40 Series: Definitional Extensions of PSL

Part 41 : Activity Extensions
Part 42 : Temporal and State Extensions
Part 43 : Activity Ordering and Duration Extensions
Part 44 : Resource Roles
Part 45 : Resource Sets
Part 46 : Processor Activity Extensions

Who is PSL's target audience ?

- **End users of PSL** : Engineers who need to exchange process information among applications within their company (and among partnering companies)
  - originally manufacturing
  - now : construction, software engineering, …

- **First step** : Get software developers to incorporate PSL translators into their tools

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ISO 18629 PSL standard : APPLICATION TO THE BUILDING SECTOR (PhD on-going, G. Tesfagaber, University of Loughborough, UK)

Objective : interoperability among 3 software applications commonly used in building engineering :

- **CAD :** AutoCAD v13
- **Planning :** MS Project 98
- **Estimating :** CCS Estimating

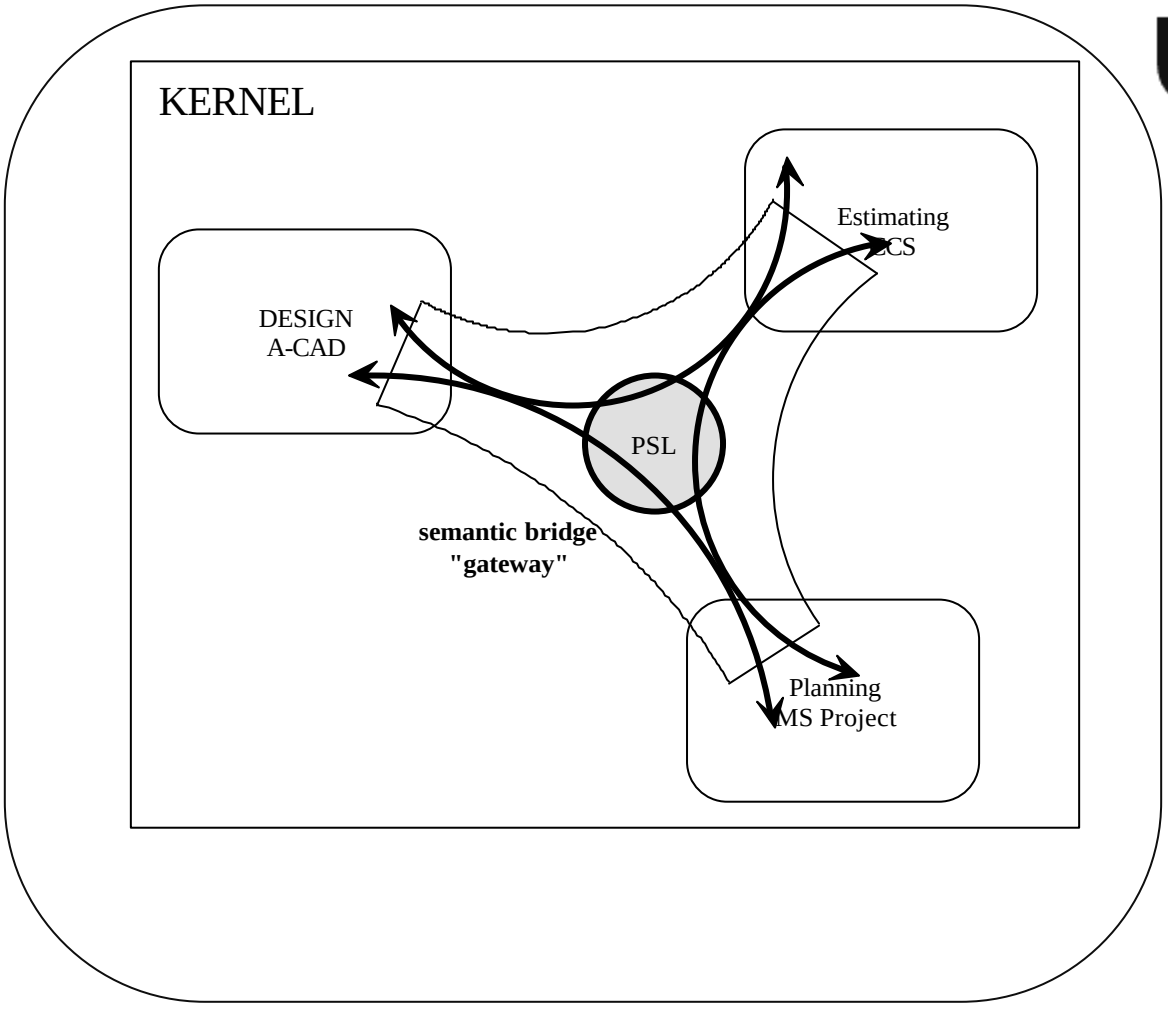
*** information related to technical processes**
*** high level semantic : exchange of *knowledge* among the models**
*** development of a generic process model (IDEF3)**

APPLICATION TO THE BUILDING SECTOR

Scenario :

* project : office building -- first appraisal : OK
* change of an industrial supplier : application to the (internal and external) doors
* new appraisal : design, planning, estimating, feasibility of the change, consequences on cost, lead times, …

**** possible use in simulation :*
change in the supplier of an industrial product incorporated in a building



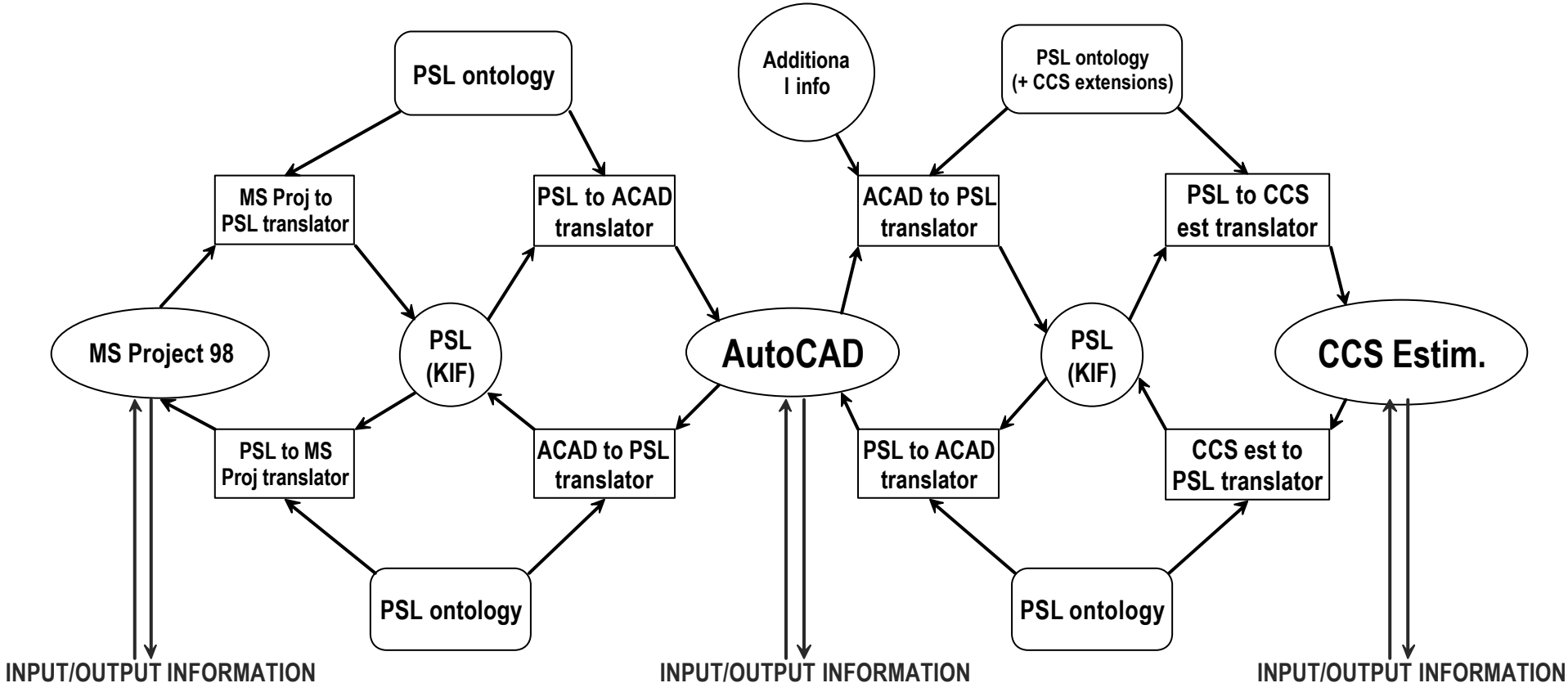
SOFTWARE ARCHITECTURE

scenarios :
- data, information
- constraints

END USER

user : fills forms : --> IN
OUT : cost, duration, ... feasibility

Structure of the scenario



Benefits of the PSL approach

- **Consistency checking at every stage** of the language
- **Rigourous definition of the language,** based on First Order Logic

  The language (and the standard) proceeds further on a

  "as-needed" basis : the initial scope of the language may be enlarged to integrate other domains, where

  high semantic level exchanges are needed :

  – **construction sector -- current research work done at the University of Loughborough (UK)**
  – **cross exchanges between industrial sectors : research project, University of Loughborough (UK)**
  – **others ….**

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